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BRAIN SURGERY:—INJURY RECEIVED FIVE YEARS AGO FOLLOWED THREE YEARS LATER BY CONVULSIONS AND PARALYSIS—BLOOD-CLOT FOUND UNDER THE DURA MATER AND REMOVED—PATIENT IMPROVING.

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(Clinic given at Wesley Hospital, Jan. 27th, 1893.)

Mr. K., aged 47 years. Father died of apoplexy. Mother lived to old age. Lost a sister aged 30 years from consumption. He enjoyed good health up to two years ago. During the fall of 1887 he was sand-bagged and robbed on the street while going home in the evening. Was struck on the head with some metallic instrument. The scalp was torn open to the extent of about an inch, over the upper and middle part of the right parietal bone, extending outwards from near the median line. He was stunned for a few minutes only. The wound was dressed by his wife; it healed in a few days. The patient went to work the morning after the occurrence and felt as well as usual, barring a little tenderness about the wound. He had forgotten all about this important incident until reminded of the presence of a scar upon the scalp. Two years ago his limbs swelled and a physician said he had Bright's disease. At the same time his head troubled him. Was afflicted with vertigo. There was a constant headache and tenderness on the right side of the skull. After a few weeks of suffering he was suddenly seized with "spasms" of the left side of his face and of the left arm and leg. These spasms began in the left fingers, extended up the arm to his shoulder, next over the entire left leg. His head turned to the left side and there was a constant twitching at the left angle of the mouth. Lost the use of his limbs for several days after the attack. Could not talk well afterwards; his memory became impaired and sensations were dull on the entire left side from that time on. The convulsions came five times—several months apart—within two years. Each successive paroxysm was longer and more severe than the preceding one. Had the last attack of the five before entering the hospital a few days before Thanksgiving, '92, at which time he was almost comatose for 36 hours. Since coming here, Dec. 21, '92, the

convulsive seizures have occurred on an average about once in twelve days.

Symptoms during the seizure.—Clonic convulsions beginning in the second finger of the left hand, Immediately after the "initial" symptom appeared in the finger the convulsions extended to the other fingers, wrist, arm and shoulder in rapid succession, also to the muscles of the face and leg. Teeth came firmly together causing a "gritting" movement. Several times the tongue was bitten. These symptoms of irritation were followed by a period of unconsciousness and hemiplegia, the unconscious state lasting from a few hours to a day. The paralysis only partially disappeared. The limbs could be moved although he had little use of them. The left hand was closed most of the time. With a little effort he could open it. Hand pressure was very weak compared with the right one. Upon waking he looked dazed. There was almost complete hemianæsthesia, and a constant twitching at the left angle of the mouth; also ataxic and amnesic aphasia. Memory greatly impaired.

Status Presens.—Is in fair flesh; has a good appetite; digests well. Presents a "nervous look." Has partial hemiplegia of the left side. Drags the left leg while walking. Carries his left hand closed. Muscular power greatly diminished. Pressure with left hand very feeble. There is limited motion of the left arm. Can lift it to the horizontal with shoulder, slowly; left hand opens slowly. There is almost complete loss of general and tactile sensation. Hemianæsthesia may be said to be almost complete. Is unable to tell which finger or toe is being pricked with a pin. Does not feel it about the face. Our interne, Dr. Boomer, stuck a pin almost through the lobe of the left ear and the patient gave no evidence of having felt it. Touch any portion of the left half of the body and extremities with bottles of hot water, he takes no notice of the heat. A snowball was placed against his left arm, leg and face without his knowledge. He remained ignorant of its presence. Cannot add a column of six simple numerals. Does not know the value of the figures. Does not know when he had the last convulsion. Cannot remember when his wife called to see him last, although she was here yesterday. His vocabulary is limited. Is afflicted with both amnesic and ataxic aphasia. Speaks a word hesitatingly; seems too tired to speak another; shakes his head; evidently cannot think the word. Cannot write a connected sentence of five words. Drops one or two words in the effort. Left eye—fundus very much congested; vision 20-60. Right eye—vision 20.20.

I have given you a brief history of the case as elicited

from his wife, and by personal observation during the short time that the patient has been under our care.

Naturally the symptoms point to lesion of the brain.

The question now arises, what is the lesion and how can we make a diagnosis?

The answer to these questions may be given most expeditiously by recalling the symptoms of diseases of the brain and its membranes. These are divided into general and localization symptoms. The general symptoms, which may accompany any disease or injury of the brain and investing membranes, are:—

1. Headache, more or less diffuse.
2. Vertigo.
3. Psychical disturbances.
4. Convulsions.
5. Cerebral pusle,
6. Impaired vision.
7. Coma.
8. Cheyne-Stokes respiration.

The localization symptoms consist of two varieties:—

a. Symptoms of irritation.

b. Symptoms of destruction.

Among the former on the sensory side are hyperæsthesia, pain, tenderness, hallucination of the special senses.

Symptoms of destruction on sensory side are loss of sensation, anæsthesia, and loss of special senses and memories

Motor symptoms of irritation are clonic convulsions, and tetanic contractures.

Symptoms of destruction, paralysis of a part—if limited, monoplegia.

The symptoms of irritation frequently blend with those of destruction, making it difficult to tell what may be the extent of a destructive lesion; and again the loss of a function does not always mean destruction of the point of origin of a nerve. The function may be simply suppressed by the presence of a growth or other lesion. Yet the symptom is one of destruction to all intents and purposes to the patient in so far as the function of a part is lost. Still you see that this classification is to a considerable extent arbitrary. For our knowledge concerning the value of these symptoms we are indebted to the investigations of Broca, Ferrier, Horsley, and their co-workers.

In this case the localization symptoms of irritation and of partial destruction are well-marked. There are the local headache, tenderness and pain; the "signal" symptoms as first noticed by his wife, in the left middle finger, followed by clonic convulsions of successive groups of muscles; the

hemianæsthesia; tremors at the left angle of the mouth; tetanic contracture of the left levator orbicularis and of the platysma muscles; also the hemiplegia of the left side pointing

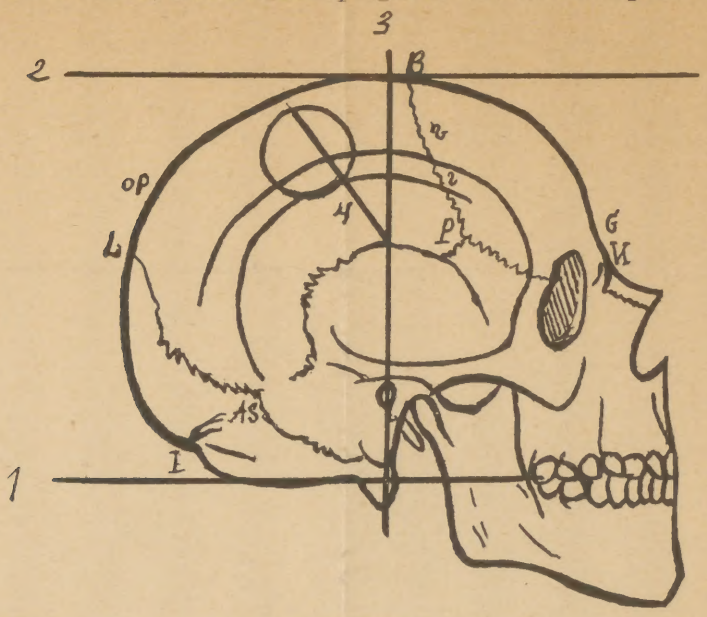

Fig. I.

1. Base line.
2. Parallel tangent line.
3. Bi-auricular.
4. Fissure of Rolando.
The circle represents trephine ring, button within.
N. Nasion.
G. Glabella.
I Inior.
B Bregma.
S. Stephanion. Superior.
s. " Inferior.
P. Pteryon.
O. P. Occipito Parietal fissure.
L. Lambdoid suture.

directly to the right side of the brain as the location of the *fons et origo* of the man's condition. Reading these symptoms in the light of modern pathological knowledge we may feel absolutely sure that there is a lesion about the cortex of the brain corresponding to the right motor area, as mapped out by Ferrier and Horsley.

The history of the case points to traumatism as the origin—causing inflammation, infection, or both, with their sequelæ. There may have resulted thickening of the bone; possibly a splinter was driven into the brain from the inner table and has led to the formation of a local abscess. There is the possibility of a blood-clot alone, or as a complication of the conditions already mentioned.

The patient's head was shaved and thoroughly scrubbed with soap and water and washed with a bichloride of mercury solution, 1 to 2000, last night. A bichloride towel was wrapped about it immediately thereafter. I now take the measurements for locating the fissure of Rolando A simple method is to project a base line from the crown of the teeth of the upper jaw backwards, which will cross the mastoid

process on a line with the condyles of the occipital bone. Next a vertical line is carried at right angles with the base line (see illustration 1,) upwards through the middle of the auditory meatus to the top of the head, bisecting a line tangent to the crown of the head and parallel with the base line. This is called the bi-auricular line and lies a little back of the bregma. (The distance from the bregma varies somewhat in different heads). At a point six cm. above the middle of the auditory meatus make a dot with tincture

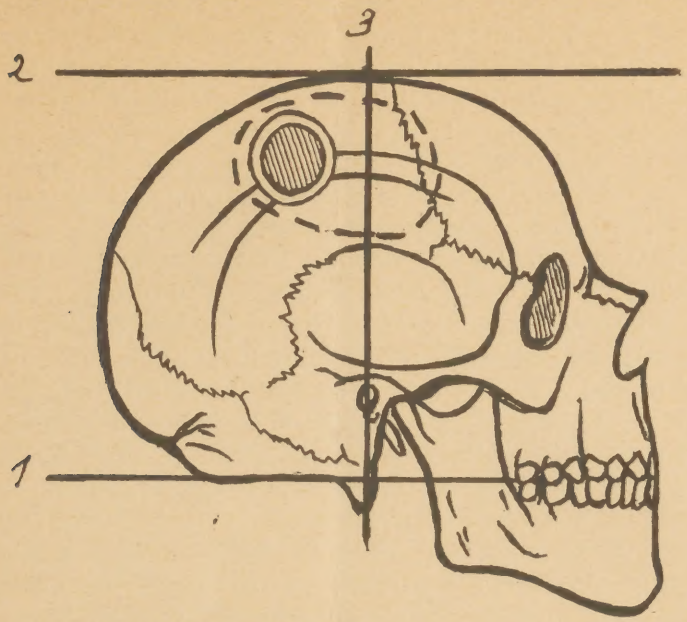

Fig. II.

1. Base line.
2. Parallel tangent line.
3. Bi-auricular line.
Circle indicates opening into skull.
Broken line of the oval indicates the area of adhesions, and bounds the space occupied by the blood clot, beneath the dura mater.

of iodine; from this dot carry a line obliquely backwards and upwards at an angle of 33 degrees with the bi-auricular line, thus. We have now marked out, approximately, the course of the fissure of Rolando. This simple method has served me satisfactorily. Having mapped out the fissure we will again wash the scalp thoroughly. Before cutting through the scalp I pierce it with a drill and mark the line for the central pivot of the trephine. This is a wise course to pursue, it saves time and may prevent the operator from falling into error. To prevent hæmorrhage the lock stitch devised by my friend, Dr. Frank, will be used. With the stitch I cut off from the circulation an elliptical area measuring 12½ by 10 cm. (5 by 4 inches). Within the area I now cut down through the scalp and periosteum, making an oval flap 6 cm wide, and lift it up from behind forwards to the extent of 7 cm., (2⅘th inches), leaving the base of the flap in front; thus

the opening on the scalp will be placed at the most dependent portion as the patient's head lies on his pillow. The flap is now held back by Dr. Cullen with sterilized, warm and moistened gauze sponges. About six years ago it was thought best to open the skull with chisels instead of using the trephine; but the pendulum of surgical opinion has swung back again so that the trephine is being used more than ever for exploratory work. In order to facilitate exploration of the cranial cavity large trephines have come into use. This one measures one-and-a-half inches in diameter. Through an opening of this size the finger can be swept about beneath the vault with great ease. It is also claimed that the dangers of causing hernia cerebri are less with a large opening than with a small one. The trephine is placed upon the skull at a point covering the fissure of Rolando, but extends farther back of it than forwards. I do this to get near the point covered by the scar. You observe that the instrument cuts its way slowly into the bone. It has penetrated $\frac{1}{8}$th of an inch and has not entered the diploe. It now sinks into the bone $\frac{1}{4}$th of an inch; the bone is still hard. One might imagine the saw is going into an osteoma. It has now passed through the bone on one side, a little more pressure on the opposite side causes it to almost complete the button. With a chisel it is readily lifted up. The button is sclerosed; is very dense, resembling compact tissue throughout almost its entire extent; its inner surface is smooth; thickness $\frac{5}{16}$ths of an inch. The density of the bone was evidently caused by inflammation and leads me to expect more evidence of the inflamatory process in the deeper tissues. The bone back of the trephine opening is somewhat irregular. I chisel away the thickened portion, extending the opening backwards $\frac{1}{4}$th of an inch. The dura is exposed. There are a number of large veins crossing it. A little manipulation causes hæmorrhage on its surface. The vessels break easily. Before opening the membrane it will be a good plan to tie the larger veins in two places, and aspirate. The needle has passed through the dura mater, a small quantity—half a teaspoonful—of blood enters the syringe. We might explore farther at this stage but it may be wiser to open the dura mater, as it should be done any way, for I find nothing between it and the calvarium to account for the patient's condition. I cut the dura mater $\frac{1}{4}$th of an inch from the margin of the bone, the incision is carried around $\frac{3}{5}$ths of the circumference of the skull opening, leaving the attached portion above and in front. The $\frac{1}{4}$th inch margin is left to give room for stitching. The membrane is very thick; it presents a yellowish appearance and cuts like leather. In the lips of the cut dark blood can be seen. As the dural flap is lifted

up a clot comes into view. By inclining the head to the right side we cause the clot to glide out; it is semiliquid; quantity about two tablespoonsful. The fact that the blood is partly liquid is an indication that it may have been encysted. We shall probably find adhesions between the membranes, surrounding the area occupied by the blood. There is considerable lymph in the arachnoid membrane all over the exposed surface. You now see the advantage of a large opening in the skull. My index finger passes readily under the cranial vault and can be swept about its circumference two inches forward and downward, an inch backward and half-an-inch inward to the longitudinal sinus. Around the entire area there are adhesions present showing that there has been at least a localized meningitis here, and probably a leptomeningitis. The arachnoid cannot be separated from the pia mater. Looking closely at the exposed surface you can see the membranes are as one, and are thickened by lymph deposits. I tear the adhesions asunder between the arachnoid and dura mater by *very gently pressngi* against them, the force of the pressure being directed towards the outer membrane. No hæmorrhage worth mentioning follows this procedure in the present instance. My fingers are a little blood-stained. I will now explore the brain farther with the needle. It has entered the ascending frontal convolution towards Broca's speech center. Only a little brain substance enters the syringe. Next it pierces the posterior portion of the ascending parietal convolution, behind the fissure of Rolando and above it. Notice the patient's left leg jerk as the needle enters the cortex. We are exploring the leg center, and have produced a symptom of irritation. The needle now enters directly behind (or as nearly as one can compute) the Rolandic fissure near the hand and finger centers. I find no evidence of abscess in any of these points, and would hardly be justified in exploring farther in the presence of the pathological conditions already found. We will now wash the exposed parts with sterilized water, using very little pressure with the syringe, having first surrounded the tissues involved with sterilized gauze sponges to prevent the water from pouring into the sub-dural space beyond the limit of disease. There is a dark appearance of the deep membranes in spots, probably due to deep congestion of the pia mater, and the brain seems to yield more readily to pressure here as if it was a little softer than in other parts. It may be well to aspirate one of these parts. There is no pus present.

As the vessels of the pia mater dip into the brain, the presence of softening of the brain would not surprise me. Leptomeningitis is said to be a cause of such a pathological

condition. Were we confident that the brain tissue had undergone degeneration it would not be justifiable, in the face of what has already been done, to extirpate it. Removal of it would produce permanent monoplegia. Not knowing what nature might accomplish by the regenerative process we would be unwise to disturb it. I will now proceed to close the wound, by first stitching the dura mater with cat gut, in continuous suture, leaving a small opening at the lowest part for drain and insert a small drainage tube, having chiseled a groove in the margin of the button and taken out a few chips of the parietal bone directly opposite to prevent pressure on the tube. The precaution of drainage is important, to permit a flow of the increased secretion of arachnoid fluid which is liable to follow this operation. The dura is closed. The button of bone and the chips are replaced. The scalp is stitched with silkworm gut, an opening being left at the lowest portion for the drainage tube. I now remove the lock stitch. Next I dust iodoform over the scalp wound, cover the head with two layers of iodoform gauze, four layers of sublimate gauze, place a thick layer of cotton around the entire head and a Moorish bandage, or cap, over all.

Ladies and gentlemen I thank you for your attention and we will keep you informed of the progress of the case in the future.

NOTE:—Feb'y. 21. The patient lifts his left leg and bends the knee while walking. Before the operation he dragged the leg. The twitching at the left angle of the mouth ceased three weeks ago. General and tactile sense partially restored. Says he feels his left arm and leg, as if there was life in them; they seemed dead before. Can recognize which finger is touched with a point of a pin, without seeing it. The ear is sensitive to the touch. Headache has left him. Talks better, frequently speaks a sentence of a dozen words. Sometimes the words come smoothly and rapidly, at other times somewhat hesitatingly. Brain tires easily. An hour and a half after the operation was completed he said, "Dr. can't you shut off that man's whistle?" referring to a patient in an adjoining room whose whistling annoyed him. The words were spoken distinctly and with little hesitation. Two weeks ago he could not open the left hand or lift the fingers. Now he opens the hand widely and extends the fingers. Has had no convulsions. Is improving daily. I omitted mentioning that our patient took iodide of potassium up to two weeks preceding the operation to make sure that no error should occur in operating. There was no indication of syphilis and the history of traumatism had not been ascertained. As already mentioned, the gentleman said nothing about the injury to the scalp until it was discovered by ocular and digital examination, and his attention was called to it.

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